

## MEMORANDUM

TO: Tom Jacobus (WA)  
FROM: Bill Rue  
SUBJECT: Status on Washington Aqueduct Water Quality Studies  
DATE: 01 September 2000

The workplan for the Washington Aqueduct water quality studies was officially approved by U.S. EPA Region 3 on 24 June 1999. Since that date, EA scientists have been working to complete the technical studies discussed in the workplan. Most of these studies have involved collecting samples or evaluating river conditions during “solids releases” which can only occur during high river flow conditions ( $>3.5$  bgd). The six basic tasks in the Aqueduct work plan are each discussed below.

### **1. Potomac River Modeling for Effluent Dilution and Fate**

The numerical model of the Potomac River is intended to simulate both river flow and the suspended solids plume from the Washington Aqueduct discharges. The primary objective of the modeling is to determine acute and chronic dilution factors as a function of effluent loading and river flow. The determination of both water column dilution factors and the spatial distribution of particle deposition will allow potential areas of concern to be identified. The proposed model domain extends from slightly upstream of Outfall 002 to the downstream end of Roosevelt Island.

Field work conducted this summer generated site-specific data for model parameterization and calibration, included the following tasks:

- Bathymetric Survey of the river
- TSS plume mapping during discharge events at Outfalls 002 and Outfall 003
- Particle size distribution and settling velocity data for effluent samples, and a
- Rhodamine dye study to determine near- and far-field dispersion coefficients.

EPA Region 3 and U.S. F&W staff, as well as a local citizen observed portions of these studies and were talked through the field efforts being performed.

The model grid with assigned bathymetry values has been established. Input files containing the time variable Potomac River flow and tide data during the survey periods have been constructed for use in the model calibration. Following model calibration, scenarios will be executed to predict the distribution of particles and dilution factors at the edge of acute and chronic mixing zones.

## 2. Effluent Toxicity Testing

The toxicity of the discharges to freshwater test species are to be quantified to determine whether the effluents have a “reasonable potential” to be toxic at the edge of mixing zones. Acute toxicity testing is being conducted on whole effluent samples, and chronic toxicity testing is being conducted on the supernatant from settled whole effluent. Benthic sediment toxicity testing are being conducted on the settled solids portion of the whole effluent. Results from the initial toxicity testing were shared with the F&WS and U.S. EPA.

### 2.1 Whole Effluent Acute Toxicity Testing

The acute toxicity testing plan consists of four separate events during 1 year, using dilutions of whole effluent samples. Three sets of tests have been conducted to date using the two standard freshwater test species.

In addition to the *D. magna* and *P. promelas* testing, striped bass (*Morone saxatilis*) was to be evaluated during the whole effluent acute toxicity testing portion of this study. This has not been *successfully* completed. Larvae were not available regionally for much of the spawning season, and then the test EA did conduct resulted in unacceptable control mortality (which was not dose related). The results were discussed with F&WS and EPA staff who encouraged us to try again, but recognized the difficulty of the task.

### 2.2 Particulate Phase (Supernatant) Chronic Testing

Chronic toxicity of the discharge is to be evaluated four separate times during a 1 year period using dilutions of a supernatant prepared from settled effluent samples. The chronic toxicity testing is to be performed using three species (fish, invertebrate, plant)

- < Fathead minnow, *P. promelas*
- < Water flea, *Ceriodaphnia dubia*
- < Green algae, *Selenastrum capricornutum*

Three sets of chronic tests have been conducted to date using the three test species.

### 2.3 Benthic Testing

The benthic testing portion of the toxicity characterization study is to consist of four test events during a 1 year period to address the suspended solids in the effluent samples [4 acute tests = 4 discharge events X 1 species]. Ten day acute toxicity tests (survival and growth endpoints) will be performed using the amphipod, *Hyaella azteca*.

Three sets of tests have been conducted to date using *Hyaella*.

### 3. Effluent Chemical Characterization

The workplan calls for the use of existing effluent data on concentrations of solids and key chemical constituents in the discharges to calculate preliminary projections of receiving water concentrations in comparison to ambient water quality criteria.

Existing effluent monitoring data (flow, chemical parameters) collected at the basin discharge points has been obtained from Aqueduct staff. In addition, effluent samples collected in the toxicity testing program (Task 2 above) have been analyzed for key parameters (e.g., total suspended solids, total and dissolved aluminum, total iron, total organic carbon, BOD, pH, alkalinity, and nitrogen and phosphorus compounds). These data now need to be entered into a single spreadsheet and analyzed to determine “reasonable potential” for exceeding ambient water quality at the edge of applicable mixing zones (in conjunction with Task 1)

### 4. Fisheries Issues

U.S. EPA Region III expressed concern that key anadromous and resident fish species might potentially be affected by the Aqueduct discharges based upon general life history data. Four specific goals were identified for study: (1) identify the critical life stages and habitat requirements of the fish *species of concern* in the vicinity of the Aqueduct outfalls, (2) assess the amount of potential fish habitat that may be influenced by the discharge plumes, (3) assess the overall potential for impacts to *species of concern* from the discharge, and (4) identify Aqueduct discharge management scenarios that may minimize potential impacts to fisheries resources that may be at risk.

The literature review has been mostly completed to identify the critical life stages and habitat requirements of fish *species of concern* in the vicinity of the Aqueduct outfalls. Resource agencies including USFWS, NMFS, DC Fish and Wildlife, MDNR and the Maryland Heritage Program are being contacted to obtain their data (particularly DC’s Fisheries group)

The habitat assessment study was conducted in July 2000 and examined macrohabitat features within the vicinity of the Aqueduct outfalls both inside and outside of the area of plume influence. The macrohabitat features in the reach from 100-200 meters upstream of Outfall 002 down to Roosevelt Island were mapped during a float trip of the area. Those field data and photographs are being worked up now.

Aqueduct discharge management scenarios that may minimize potential impacts to fisheries resources are actively discussed among the team. These include: allowing discharges under lower river flows to avoid releases during the spring herring migration; releasing solids over a longer period of time (e.g., 8-10 hours of cleaning rather than 2-3 hours); outfall relocation to deeper waters to enhance dilution and dispersion.

## **5. Aluminum Criteria Modification**

If aluminum is determined to exceed applicable ambient water quality standards at the edge of mixing zones, it will be important to quantify the "bioavailability" of the aluminum in the effluent so that the ambient standard can be appropriately adjusted (e.g., if the same concentration of total aluminum is half as toxic in Outfall 003 effluent than total aluminum salts are in pure lab water, EPA guidance would allow the standard to be multiplied by a factor of 2.0).

No work has been done on this task because it is uncertain at this time whether it will be necessary.

## **6. Macroinvertebrate Community Studies**

Artificial substrate samplers (i.e., modified Hester Dendy) were deployed twice to obtain quantitative samples of macroinvertebrates at upstream and downstream locations in the Potomac River. The first effort failed because of extremely low flows and strong winds which allowed several units to surface and dry out. The units were then re-deployed in slightly deeper water.

Macroinvertebrate studies focused on Outfall 003, assuming it to be the area most heavily influenced by Aqueduct discharges as a result of substantially slower river velocities (versus Outfall 002). The upstream reference location was selected to match habitat characteristics as closely as possible to the four stations downstream of Outfall 003 to minimize benthic community differences due to habitat.

Two sets of artificial substrates (with 4 replicates/set) were deployed at upstream and each of the 4 downstream locations in the river approximately six to eight weeks before a discharge event, to allow for colonization. Substrates were placed a few inches above the sediment interface and oriented so that the plates are horizontal. One set was collected before an Outfall 003 discharge event (27 April 2000), and the second set was retrieved several days after the event (8 May 2000). This approach allows for upstream and downstream comparisons, both before and after a solids discharge event.

These macrobenthic samples have been "sorted" in EA's biology laboratory and are now being identified taxonomically by EA identification specialists. The large quantity of sediment which was deposited at upstream and downstream locations during the colonization period will be a confounding variable in the study.

## **Budget Issues**

The total budget for the program is \$370,587. Invoices through 31 July were for \$167,224. Most of the field work has been completed. The remainder of the work involves writeups of the data, calibration of the hydrodynamic model, another round of toxicity tests, participation in public meetings, and interaction with agency staff.

## **Project Schedule**

One more set of toxicity tests need to be conducted to complete the four-test suite. The striped bass testing cannot be repeated until spring 2001 because larvae are not available during any other time of the year.

The majority of the technical studies will be written during the September-October timeframe, then discussed with our client group and then with U.S. EPA Region 3. The modeling section may take a little longer than this because of the complexity of the effort. We also expect to participate in a public meeting with Aqueduct staff sometime during the fall.